

# MILK ANALYSIS: a whey to predict composition

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## Why milk?

- Milk is a **complex matrix** containing proteins, fat, carbohydrates, minerals, and biologically active compounds
- Produced by **different species of animal**
- Over 897 million metric tons a year are **produced for human consumption** (worldwide), being about **80% from cows**<sup>1</sup>

## Composition assessment

- Milk composition is often used as **quality and payment parameter** for the dairy industry.
- Efficient and high precision** of measurements are required
- MIR spectroscopy** is the preferred method for routine quantification (performed daily for all NZ milk)

## MIR Spectroscopy of Milk

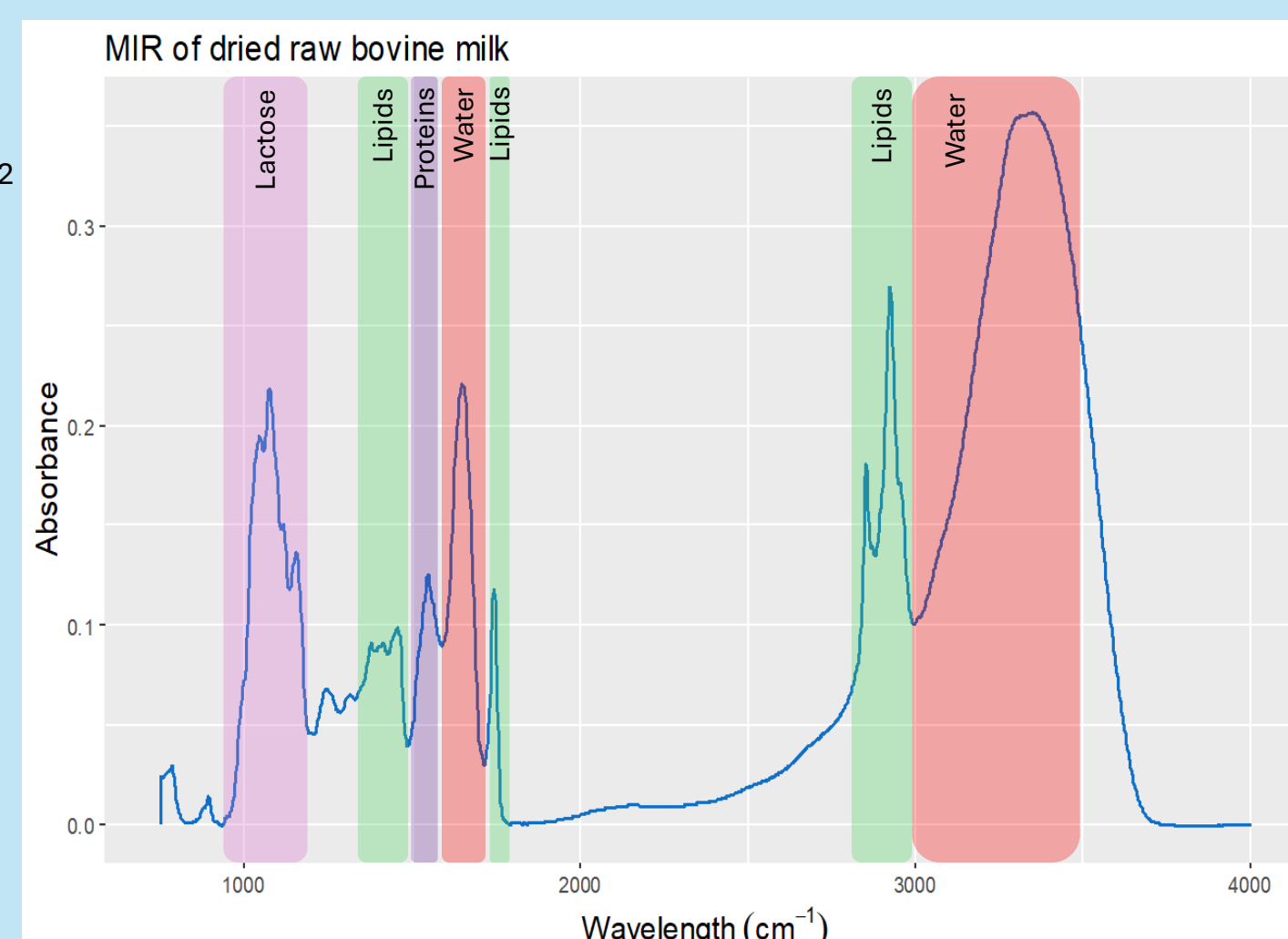
Mid Infrared (MIR) spectroscopy is a technique that uses electromagnetic waves and the vibrational frequencies of molecules **to identify compounds and their amount in milk samples** (see Milk Composition Model Workflow).

### Advantages

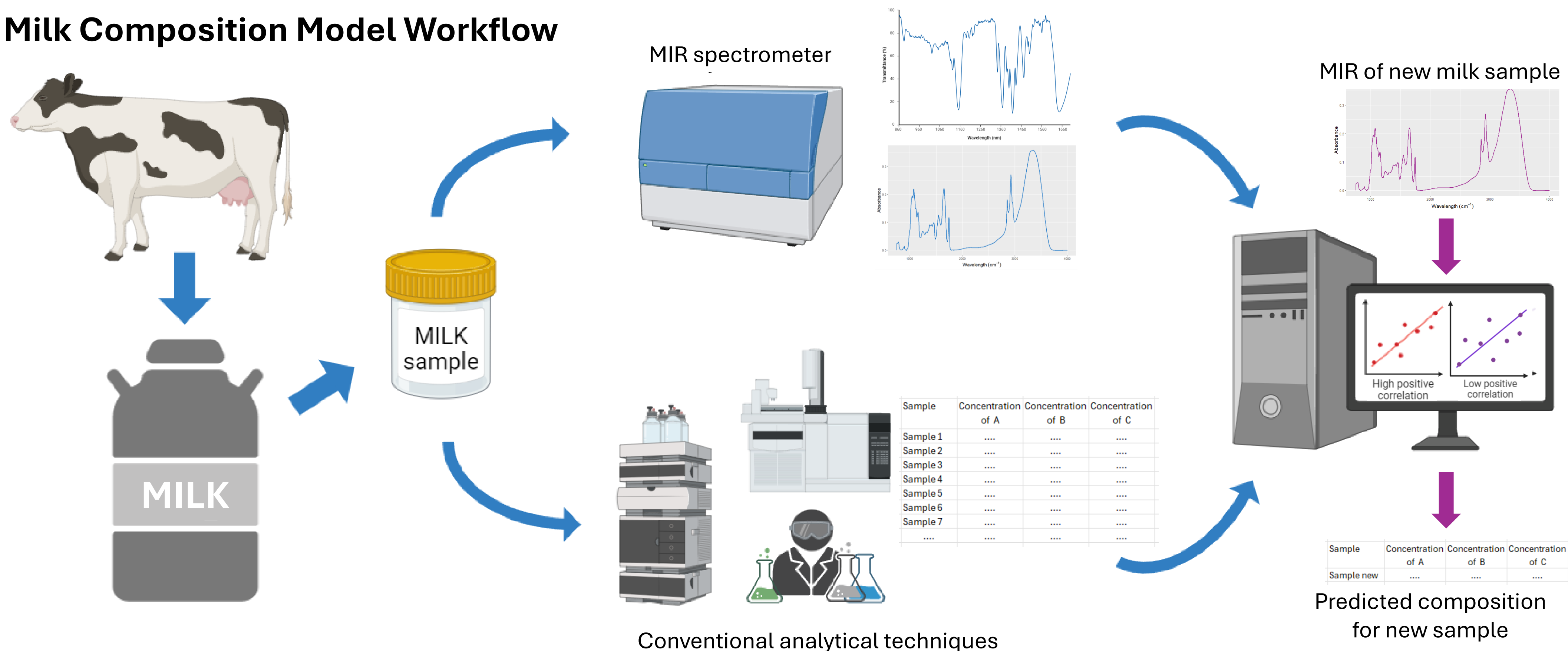
- Rapid and cost-efficient** compared to traditional quality assessment techniques<sup>2</sup>
- Ecofriendly**, no chemicals needed
- Does **not require sample preparation** - can be used in production lines

### Limitations

- Water can mask signals** of other components of interest (red regions →)
- Relies on **mathematical models to relate MIR spectra to composition measurements** from traditional methods (see This Research)
- Difficult to distinguish** between similar components, e.g. individual fatty acids



## Milk Composition Model Workflow



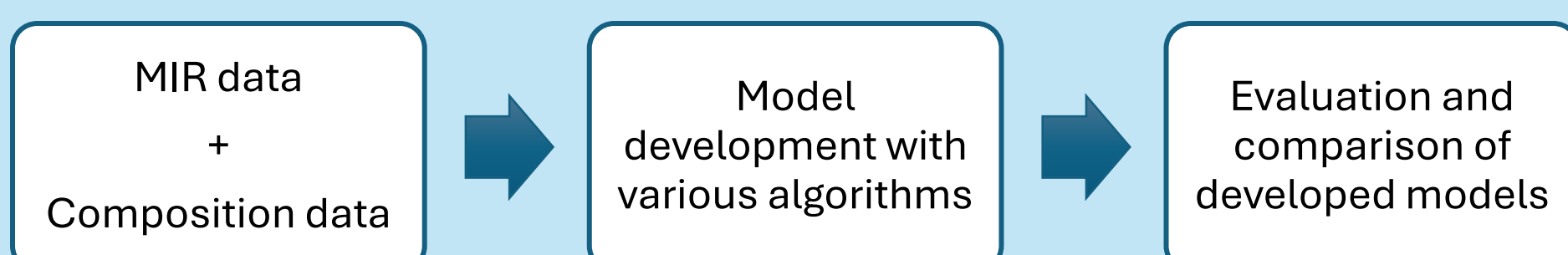
## This Research

**Aim:** Develop new, improved, mathematical models relating MIR spectra to detailed milk components (including individual fatty acids and specific proteins).

**Method:** Composition data from conventional analytical techniques and MIR data will be modelled using both:

- Current “gold standard algorithm”; Partial Least Squares Regression, and
- Emerging machine learning algorithms; such as Artificial Neural Networks and Support Vector Machines

These models will be **developed, evaluated and compared for predictive performance.**



**Results:** Due to commercial sensitivity, results cannot be shared at this time, but we expect to obtain reliable and accurate models using these alternative algorithms that can be used to improve quality assessment of milk.

## Applications and Impact

The creation of accurate models for detailed compositions could be used to improve aspects of the dairy industry, by:

- Providing milk producers with **information on milk quality /improve payment schemes**
- Detection of use of **feed supplements**<sup>5</sup>
- Detection of **adulterants** in milk<sup>6</sup>
- Distribution of milk to be **used in appropriate subproducts** (i.e. cheese, cream)



## References

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